

No. II.—REPORT ON THE ECHINODERMA (OTHER THAN HOLOTHURIANS)
COLLECTED BY MR. J. STANLEY GARDINER IN THE WESTERN
PARTS OF THE INDIAN OCEAN.

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(*Communicated by J. STANLEY GARDINER, M.A., F.R.S., F.L.S.*)

(Plate 3.)

Read 5th November, 1908.

SOME time since Mr. Stanley Gardiner forwarded to me the large collection of Echinoderms made by him in the Indian Ocean; the collection was contained in about 150 bottles and tubes, together with about 20 dried specimens, and the work has been laborious from the number of species placed together in one bottle.

It is now rather more than a quarter of a century since I received a collection made by H.M.S. 'Alert' in the Western Indian Ocean; since then considerable additions to our knowledge of the fauna of Mauritius have been made by the admirable memoirs of M. de Lorient, while a summary of our knowledge of the area involved is to be found in the 'Echinodermes des Sansibargebietes,' prepared by Prof. Ludwig in 1899. I do not propose therefore on this occasion to enter into those bibliographical details in which, to my wonder, so many zoologists appear to take delight.

Not only were the bottles and boxes numerous, but they nearly always contained specimens belonging not only to different species but to different divisions of the phylum. A very large number of the specimens were immature; I have no doubt that workers in some other branches of zoology have had from time to time to complain of the description of species drawn up from immature specimens, but I do not think that many groups have suffered so severely as have the Echinoderms. While the study of the species of this group was still comparatively in its infancy, a large circumnavigating expedition brought home considerable collections, many of which were isolated forms, which upon examination have proved to be immature. There is reason to believe that I have myself been at least once a sinner in this respect, but I hope to be able henceforward to put a better restraint upon myself. I am not, let it be understood, complaining of the existence of immature forms in this or any other collection. When we are able to get to what is, I suppose, the real business of systematic zoologists, the study of the evolution of the species which we and our predecessors have established, these immature forms will prove of the highest value and interest. I have now a good collection of these forms from various parts, and I am looking forward to the time when they shall be put to use.

Following the habit that I have practised for some years, I have refrained from describing any new species of the genus *Ophiothrix*. It is certain that a number of varieties have been described in this genus, and, considering the great variation seen amongst specimens in our own seas, it is clear that the description of isolated specimens is absolutely opposed to sound taxonomic principles. Mr. Gardiner has been kind enough to allow the unnamed specimens of *Ophiothrix* to remain in the custody of the British Museum, and anyone who sees leisure in front of him for ten or twelve years is invited to undertake the work of revising that genus.

The collection was carefully labelled, and I have, I think, invented a method which will put into exceedingly small compass the results of a very laborious undertaking. I can only wish that they could have done more to settle the problems which my friend's expedition went out to solve, but, as was pointed out in the Report of the 'Alert' five-and-twenty years ago, there is for Echinoderms an inter-tropical marine fauna, and these creatures naturally are found now in one island and now in another, so that they throw no light on the relations or differences of the islands of the Western Indian Ocean.

After the studies of the happily still * living M. de Lorient, whose contributions to the Echinoderm fauna of Mauritius are so well known, it was not to be expected that many novelties were to be found, but there is one fine new genus which I have ventured to dedicate to this veteran in science. In his and the three other memoirs given below, information will be found as to most of the species in my list:—

- Hartlaub, Dr. C.—Beitrag zur Kenntniss der Comatuliden-Fauna des Indischen Archipels. 120 pp., 5 pls. Nova Acta Leop.-Carol. Deutschen Akad. d. Naturf. Bd. lviii. Nr. 1 (1891).
- Lorient, P. de.—Cat. Raisonné des Echinodermes à l'Île Maurice. 64 pp., 6 pls. Mém. Soc. de Physique d'Hist. Nat. de Genève, xxviii. No. 8 (1883). [I. Echinides & *Brisingaster*.]
- Cat. Raisonné des Echinodermes à l'Île Maurice. II. Stellérides. 84 pp., 16 pls. *Op. cit.* xxix. No. 4 (1885).
- Cat. Raisonné des Echinodermes à l'Île Maurice. III. Ophiurides et Astrophytides [& Crinoides]. Pp. 1–59, pls. xxiii.–xxv. Supplement [Echinides & Stellérides], pp. 60–63, pl. xxv. fig. 6. *Op. cit.* xxxii. 1st pt. No. 3 (1893).
- Köhler, R.—Echinodermes recueillis par l'*Investigator* dans l'Océan Indien. Ophiures Littorales. 70 pp., 4 pls. Bull. Scient. France et Belg. xxxi. (1898).
- Ludwig, Dr. L.—Echinodermen des Sansibargebietes. 27 pp. Abh. Senckenberg. naturf. Gesellschaft, xxi. (1899) pt. 4.

List of described Species taken by Mr. Stanley Gardiner.

I. ASTEROIDEA.

<i>Echinaster purpureus</i>	. . . . .	DR.; CC.
<i>Acanthaster mauritiensis</i>	. . . . .	Praslin; Egm.
<i>Linckia laevigata</i>	. . . . .	SdM.; CP.; Coetivy Rf.
„ <i>marmorata</i>	. . . . .	Egm.; CC.; Sal.; Chag.; Seych.
„ <i>multiforis</i>	. . . . .	Coetivy Rf.
„ <i>diplex</i>	. . . . .	DR.; SdM.; Sal. At.; Egm.

* [This was written nearly a year ago: M. P. de Lorient Le-Fort died on the 23rd of December last.—F. J. B., 24/4/09.]

<i>Scytaster variolatus</i>	Am. 35 * ; CC. ; CC. 30 ; FA.
„ <i>tuberculatus</i>	CC. 30.
<i>Leiaster leachi</i>	Am. ; Am. 25-80 ; Am. 30 ; Seych. 34 ; Coet. Rf.
<i>Pentaceros graciüs</i>	SdM. 45 ; SdM. 55.
„ <i>nodosus</i>	SdM. 45.
„ <i>lincki</i>	SdM. 46.
<i>Culcita coriacea</i>	Seych.
<i>Astrodiscus elegans</i>	Am. 44 ; Am. 25 ; SdM.
<i>Gymnasterias carinifera</i>	DR. ; Sal. ; Sal. At. ; DR. ; CP. ; Egm.
<i>Asterina cepheus</i>	Seych. ; SdM. 26.
„ <i>exigua</i>	Sal. ; Sal. At.
<i>Astropecten hemprichi</i>	SdM. 125 ; Prasin.
„ <i>polyacanthus</i>	Am. ; S. ; Seych. 31 ; SdM. 47 ; DG. 14.
<i>Lidia maculata</i>	CC.
„ <i>savignii</i>	SdM. ; SdM. 55.
„ <i>hardwickii</i> ?	SdM.
<i>Retaster cribrosus</i>	Seych. ; CC. ; Seych. 44.
<i>Acanthaster mauritiensis</i>	Sal.
„ <i>echinites</i> (distorted)	SdM.
<i>Brisingaster robillardi</i>	O. ; SdM. 450 ; Sal.

II. OPHIUROIDEA.

<i>Pectinura gorgonia</i>	Am. 29 ; SdM. 26.
„ <i>rigida</i>	Am. 30.
<i>Ophiolepis annulosa</i>	Sal.
<i>Ophioplocus imbricatus</i>	PR.
<i>Ophionereis dubia</i>	CP. 32.
<i>Ophiocoma scolopendrina</i>	CP. ; PR. ; Am. 25-80.
„ <i>erinaceus</i>	CP. ; Egm. ; Seych. ; Coetivy ; Am. 20-25.
„ <i>lineolata</i>	CP. ; Egm. ; Coetivy ; Am. 25-80.
„ <i>valenciæ</i>	CP. ; Sal. ; Egm. ; Coetivy ; Am. 25-80.
<i>Ophiarthrum elegans</i>	Sal.
<i>Ophiothrix triloba</i>	CC. 30.
„ <i>longipeda</i>	CP. ; PR. ; Egm.
„ <i>aspidota</i>	CC. ; Am. 25-80.
<i>Ophiomyxa robillardi</i>	Amir. 30.
<i>Trichaster palmiferus</i>	SdM.
<i>Euryale aspera</i>	Prov.
<i>Gorgonocephalus verrucosus</i> (immat.)	Prov. 50.
<i>Ophioterresis elegans</i>	SdM. 26 & 29 ; Am. 29 ; CC. 20-50.
<i>Neoplax ophiodes</i>	SdM. 3-500 ; Am. 25-80 ; CC. 30.

III. ECHINOIDEA.

<i>Cidaris metularia</i>	DR. ; Sal. ; Sal. At. ; DR. ; PR. ; CP. ; Egm. ; Coetivy ; SdM. 29 ; Seych. ; CC. ; SdM. 26 ; Seych. 39 ; Seych. 34.
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* The numbers indicate depth in fathoms, where they vary from those given on the next page.

<i>Cidaris baculosa</i> *	SdM.; Am.; Am.; CP.; Egm.; CC.; Am. 20-25 ; SdM. 55.
„ <i>verticillata</i> *	CC.; CP.
<i>Phyllacanthus annulifera</i>	Egm.
<i>Diadema saxatile</i>	DR.; Am. 35 ; PR.
<i>Echinothrix desori</i>	Am.; Sal.; Egm.; ? Prov.; Am. 20-25 ; CP.
„ <i>turcarum</i>	Sal.
<i>Astropyga radiata</i>	CC.; Seych. 44; SdM. 55; Praslin.
<i>Salmacis bicolor</i>	CC. (pale var.); SdM. 47.
<i>Echinostrephus molare</i>	Sal.; Sal.
<i>Toxopneustes pileolus</i>	Am. 35 ; Seych.
<i>Tripneustes angulosus</i>	DR.; Seych.; SM.; CP.
<i>Parasalenia gratiosa</i>	Egm.; CP.; CC.; Diego Lagoon.
<i>Echinometra lucunter</i>	DG.; CC ¹ ; DR.; PR.; CP.
„ <i>oblonga</i>	DR.; PR.
<i>Echinoneus cyclostomus</i>	CP.
<i>Fibularia volva</i>	Seych.
<i>Clypeaster humilis</i>	P.; Am.
„ <i>subdepressum</i>	Am. 30.
„ <i>scutiformis</i>	SdM.; Seych. 30; SdM.
<i>Echinolampas oviformis</i>	Am ³ .
<i>Laganum decagonale</i>	Am. 30 ; CC. 30.
<i>Echinoneus cyclostomus</i>	Sal.; CP.
<i>Maretia planulata</i>	CC.; S.; Seych. 39; Seych. 44; CC. 30.
„ <i>alta</i>	CC.
<i>Lovenia subcarinata</i>	Seych. 39.
<i>Brissus unicolor</i>	Sal.

IV. CRINOIDEA.

<i>Actinometra multiradiata</i>	Sal.; CP.
<i>Antedon carinata</i>	SdM. 300-500; CC.; FA.; Seych. 15.
„ <i>palmata</i>	FA.
„ <i>spicata</i> †	Seych. 39.

Details of Stations.

Am.	Amirante, 22-85 fms.	DR.	Desroches, 280 fms.
Am ¹ .	Amirante, 25 fms.	Fgm.	Egmont Lagoon, 6-7 fms.
Am ² .	Amirante, 44 fms.	FA.	Farquhar Atoll, N. Reef.
Am ³ .	Amirante, 160-209 fms.	P.	Providence.
At.	Atoll.	Prov.	Providence, 70 fms.
CC.	Cargados Carajos, 30 fms.	PR.	Praslin Reef.
CC ¹ .	Cargados Carajos.	S. or Seych.	Seychelles.
Chag.	Chagos Archipelago.	Sal.	Salomon.
CP.	Coin Peros.	SdM.	Saya de Malha, 55 fms.
DG.	Diego Garcia (Lagoon).	O.	No locality stated.

* *Phyllacanthus*, teste Clark.

† I am in some doubt as to the correctness of this identification. P. H. Carpenter described the species in 1881 (Notes Leyd. Mus. iii. p. 190) from, it would appear, a single specimen; no subsequent writer that I know of has ever mentioned it.

*Notes on new or rare Species.**Stereocidaris indica.*

Stereocidaris indica, Döderlein, Zool. Anz. xxiii. (1901) p. 19; id. Wiss. Ergebn. deut. Tiefsee Exped. v. 2 (1906), p. 104; H. Lyman Clark, Bull. Mus. Comp. Zool. li. no. 7 (1907), p. 218.

Prof. Döderlein has pointed out the variations exhibited by this species; the specimens collected by Mr. Gardiner appear to vary more in the length of the primary spines than in any other particular; some of these spines are completely covered by what is, apparently, one species of Cirripede; worm-tubes and Ophiurids may also find a home on the spines, which, on the other hand, are at times singularly free of any Epizoa.

I have adopted the name given by Döderlein and accepted by Prof. Lyman Clark, though it "is the most poorly defined and unsatisfactory genus in the family," on the ground that where one has not made, like Döderlein, "twenty years' study of the family" (*cf.* Lyman Clark, *op. cit.* p. 170), or, like Prof. Clark, a profound study of the group in question, it is unreasonable not to make use of the services such students have rendered us. Personally, I greatly regret the dismemberment of genera which is now going on; a general survey of systematic zoology will come to be quite impossible if large genera, such as *Peripatus*, *Antedon*, and *Cidaris*, continue to be broken up by specialists, while the works of the founders of our science will have to be re-edited and annotated.

. Saya de Malha, 150 fms.

LYSASTER, gen. nov.

This new genus is a *Pentagonasterid*, having some of the characters of *Iconaster*, in that the supero-marginals alone form the upper part of the area, but the abactinal plates are so loosely connected with one another that they do not form a continuous roof, and this surface is soft to the touch. The interradial plates on the actinal surface bear a number of short sharp spines. The sides of the disc and arms are very deep, and the granulation on the marginals is so regular that the median suture is often obscured. This granulation is coarser on the sides of the marginals of the disc than in the median part, so that each plate has the appearance of being sharply separated from its neighbour; this difference in granulation is not seen in the marginals of the arms.

As there are but two specimens, and these almost exactly alike, it is difficult to be sure as to the specific characters, but they appear to be as follows:—

Lysaster lorioli, sp. nov. (Plate 3.)

$R=2r$; about ten marginals in each half of a ray; here and there a more or less sharp spine on the supero-marginals of the arm; the madreporite quite close to the supero-marginals. The ambulacral groove is bounded by a single row of moderately developed spines, beyond which is a row of smaller and less numerous spines.

Colour in alcohol: the margins and lower surface white, the sides of the marginals of the disc and the central abactinal area somewhat darker.

$R=57.5$; 55.5 . Depth at angle of disc 10 mm.

Mauritius, 500–600 fms.

I have dedicated this species to the distinguished Swiss naturalist who has added so much to our knowledge of the Echinoderms of Mauritius.

Iconaster gardineri, sp. nov.

I have placed three specimens of different sizes in this genus, and I may remark of one of them that it is so minute that it does not exhibit the leading characteristic of the genus, which is, in the words of Mr. Sladen, "supero-marginal plates united throughout the length of the ray"; here, again, is a lesson against giving definite names to small Starfishes. I do not notice in the new species "peculiar valve-like plates" at the margins of the adambulacral, but it is to be observed that they are not regularly present in specimens of *I. longimanus*, which is the type of the genus; moreover, I do not think that so inconstant a character should be used as a criterion of generic rank. Reference is, further, made to "the character of the adambulacral armature," but nothing more definite is said on that point.

There is, I think, no disadvantage in placing this new species in an already recognised genus—for the present at least; it is, as we all too well know, quite easy to make a new genus, if thought necessary, later on.

The specific characters appear to be: R about equal to $2r$; body almost flat, marginals large, about 20 in number; granulation rather coarse, very uniform, madreporite not far from centre of disc.

None of the specimens are quite complete.

Saya de Malha, 125 fms.

Astronyx cooperi, sp. nov.

In general appearance very much like *A. loveni*, but the radial shields are entire, not broken, and, in the adult, the outer arm-spine is very much longer and is not hook-shaped.

These two characters are sufficient to distinguish the Indian Ocean species from the northern circumpolar form. The difference in the arm-spines throws light on the importance, more than once insisted on in this paper, of taking care not to diagnose species from immature specimens; in the two smaller examples now lying before me the spines near the disc are small and inconspicuous, though those further out are longer. In the longest specimen the size of all but the most proximal spines is quite striking, and, I think, satisfies the requirements of any creator of a "new species."

Saya de Malha, 150 fms.

EXPLANATION OF PLATE 3.

Fig. 1. *Lysaster lorioli* from below, somewhat reduced from nat. size.

Fig. 2. The same surface slightly magnified, to show the oral armature and the disposition of the adambulacral spines.

Fig. 3. *Lysaster lorioli* from above, somewhat reduced from nat. size.

Fig. 4. The same surface slightly magnified, to show the loose arrangement of the dorsal ossicles.